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# **Three Players Nash Equilibrium Game Concerning the Charging Time and Place of Employee Electric Vehicles**

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## **ABSTRACT**

In this study, we model the demand for and supply of charging facility at workplace, and the associated consequences on social welfare. We found that both employers and workers benefit from the accessibility of workplace charging when: i) they agree to pay for workplace charging out of gross salary and when the labor tax is high; ii) employers pay less electricity tariff than households do; iii) the employment contract duration is long; iv) recharging electric vehicles (EVs) takes longer time and the value of time is higher. Accessibility of cheaper charging facility at workplace, while saves the charging time and increases the share of EVs as commuting mode, it results in unintended consequences including electricity peak-load problem, an increase in electricity tariff for household use, and an increase in car use that worsens traffic congestion. For the electricity supplier, workplace charging increases the cost of supplying electricity by aggravating the daytime peak-load problem and by increasing the demand variation from the mean. Tax based on yearly travel distance, and restriction on free workplace charging access improves social welfare. The results from this study are relevant in (i) helping to predict the choice of time and place of charging of employees' EVs, (ii) supporting employers to understand the implications of workplace charging provision, (iii) providing electricity suppliers with information for better electricity demand predictions, and (iv) revealing to policy makers the non-taxed fringe benefit problem of charging at the workplace.

**Keywords:** Electric Vehicle, Workplace Charging, Employee, Employer, Electricity Supplier